The Present Invention

The present invention relates to processes for manufacturing hydrocarbon products, in particular, a lube base stock. In one aspect the present invention relates to a process for manufacturing a lube base stock comprising converting a light hydrocarbon feed to syngas, and subjecting the syngas to Fischer-Tropsch synthesis to form a predominantly linear hydrocarbon product. A 650°F- containing fraction comprising C_5-C_{20} hydrocarbons and a 650°F+ containing fraction, having a true vapor pressure of less than 15 psia at transportation temperature, are isolated from the predominantly linear hydrocarbon product of the Fischer-Tropsch process. In the claimed process, the 650°F- containing fraction includes greater than 75% by weight 650°F- containing product and the 650°F+ containing fraction includes greater than 75% by weight 650°F+ containing product. In the claimed process, at least a portion of the 650°F- containing fraction is converted to distillate fuels at the Fischer Tropsch synthesis site, and the 650°F+ containing fraction is transported to a refinery and converted to a lube base stock.

In other aspects the presently claimed invention relates to processes for manufacturing hydrocarbon products, such as a lube base stock and distillate fuel. In these claimed processes, at least a portion of the Fischer-Tropsch reactor and/or equipment for isolating the hydrocarbon products from the Fischer-Tropsch reactor may be disassembled, transported to a second remote natural gas field, and assembled at the second remote natural gas field.

Claim Rejections under 35 U.S.C. § 103(a)

Claims 1 – 16 and 18 – 23 are rejected under 35 U.S.C. § 103(a) as being obvious over Mauldin (U.S. Patent No. 5,968,991) in view of admitted prior art. Applicant respectfully traverses the rejection.

Mauldin relates to a process for the preparation of a catalyst useful for conducting carbon monoxide hydrogenation reactions, especially a Fischer-Tropsch catalyst, use of the catalyst for conducting such reactions, especially Fischer-Tropsch reactions, and the composition produced by the process. (Abstract). Mauldin teaches that the products from the Fischer-Tropsch reactor may be separated into C_{4-15} hydrocarbons and C_{16+} hydrocarbons. (Col. 5, lines 28-35). Mauldin teaches that the C_{4-15} hydrocarbons constitute high quality paraffin solvents. (Col. 5, lines30-31). Mauldin teaches that the C_{16+} hydrocarbons from the Fischer Tropsch reactor can be upgraded by various hydroconversion reactions, e.g., hydrocracking, hydroisomerization, catalystic dewaxing, isodewaxing, etc, or combinations

thereof, to produce products such as jet fuel, isoparaffinic solvents, lubricants, non-toxic drilling oils, technical and medicinal grade white oils, chemical raw materials, and various specialty products. (Col. 5, lines 34-45). Mauldin further teaches that the liquid product produced can be shipped from a remote area to a refinery site for further chemical reacting and upgrading to a variety of products or can be produced and upgraded at a refinery site. (Col. 5, lines 24-28).

In contrast, the presently claimed invention relates to processes for manufacturing hydrocarbon products, in particular a lube base stock and distillate fuels. In one aspect the present invention relates to a process for manufacturing a lube base stock comprising isolating a 650°F- containing fraction comprising C_5-C_{20} hydrocarbons and a 650°F+ containing fraction from a predominantly linear hydrocarbon product of a Fischer-Tropsch process. In this process the 650°F+ containing fraction is transported to a refinery, and converted to a lube base stock, and at least a portion of the 650°F- containing fraction is converted to distillate fuels at the Fischer Tropsch synthesis site. Accordingly, in the presently claimed invention, the Fischer Tropsch hydrocarbon product is fractionated to isolate a C_5-C_{20} hydrocarbon product (i.e., the 650°F- containing fraction) and a C_{20+} hydrocarbon product (i.e., the 650°F+ containing fraction). In the presently claimed invention, the 650°F+ containing fraction (i.e., the C_{20+} hydrocarbon product) is transported to a refinery and converted to a lube base stock. Also, in the presently claimed invention, at least a portion of the 650°F- containing fraction (i.e., the C_5-C_{20} hydrocarbon product) is converted to distillate fuels at the Fischer Tropsch synthesis site.

As explained in the specification and during the personal interview, it is an important aspect of the presently claimed invention that the Fischer Tropsch hydrocarbon product is fractionated such that a 650°F+ containing fraction (i.e., a C_{20+} hydrocarbon product) and a 650°F- containing fraction comprising C_5-C_{20} hydrocarbons are isolated. It is also an important aspect of the presently claimed invention that the 650°F+ containing fraction is transported to a refinery and converted to a lube base stock, and at least a portion of the 650°F- containing fraction is converted to distillate fuels at the Fischer Tropsch synthesis site.

Applicants respectfully assert that Mauldin does not disclose, teach or suggest the presently claimed process of isolating a 650°F+ containing fraction (i.e., a C_{20+} hydrocarbon product) and a 650°F- containing fraction comprising C_5-C_{20} hydrocarbons. Applicants also respectfully assert that Mauldin does not disclose, teach or suggest transporting the 650°F+ containing fraction to a refinery and converting it to a lube base stock. Applicants further

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respectfully assert that Mauldin does not disclose, teach or suggest converting at least a portion of the 650°F- containing fraction to distillate fuels at the Fischer Tropsch synthesis site while transporting the 650°F+ containing fraction to a refinery for conversion to a lube base stock.

In no way does Mauldin relate to or address problems or limitations in transporting Fischer-Tropsch derived products. Accordingly, Applicant respectfully asserts that in no way does Mauldin teach or suggest the presently claimed invention, as explained above. In addition, Applicant respectfully asserts that Applicants have admitted no prior art and no art has been cited that would supplement the deficiencies of Mauldin in this regard.

In additional aspects, the presently claimed invention relates to processes for manufacturing hydrocarbon products, for example a lube base stock and distillate fuels, including a first remote location and a second remote location, wherein the first and second locations are also remote from each other. In the claimed processes, at least a portion of the Fischer-Tropsch reactor and/or equipment for isolating the hydrocarbon products from the Fischer-Tropsch reactor may be disassembled, transported to a second remote natural gas field, and assembled at the second remote natural gas field. These claimed process provide certain efficiencies. The disassembly and transportation of disassembled equipment to a second remote location is an important feature of the presently claimed invention. As stated in the specification, "[T]he equipment used in the syngas generation, Fischer-Tropsch synthesis and/or product isolation is capable of being transported, in whole or in part, from remote location to remote location, thereby saving capital expense when a natural gas source runs dry." (page 24, lines 1 - 4).

Applicants respectfully assert that Mauldin does not disclose, teach or suggest the presently claimed process of utilizing equipment that is disassembled, transported, and re-assembled at a second remote location. The Examiner acknowledges that Mauldin does not teach at least a portion of the equipment in the remote area is transported to a refinery site. (Office Action, page 4, 2nd paragraph). However, without citing a reference or providing factual support, the Examiner asserts that it would have been obvious to one having ordinary skill in the art to have modified the process of Mauldin by transporting at least a portion of the equipment from one site to another site. The Examiner makes this conclusion without citing a reference or providing any specific facts in support of this conclusion of obviousness.

Accordingly, it is respectfully submitted that in no way does Mauldin teach or suggest the presently claimed processes for manufacturing hydrocarbon products, in particular lube base stocks and distillate fuel, of the present invention. Applicant respectfully asserts that no art has been admitted or cited that would supplement any deficiency of Mauldin. Accordingly, Applicant respectfully requests withdrawal of the obviousness rejections.

Conclusion

Without conceding the propriety of the rejections, the claims have been amended, as provided above, to even more clearly recite and distinctly claim Applicant's invention and to pursue an early allowance. For the reasons noted above, the art of record does not disclose or suggest the inventive concept of the present invention as defined by the claims.

In view of the foregoing amendment and remarks and the previous personal interview, reconsideration of the claims and allowance of the subject application is earnestly solicited. The Examiner is invited to contact the undersigned at the below-listed telephone number, if it is believed that prosecution of this application may be assisted thereby.

Respectfully submitted,
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Mark-up of Claims

1. (Three Times Amended) A process for manufacturing a lube base stock comprising:

a) converting a light hydrocarbon feed to syngas,

b) subjecting the syngas to Fischer-Tropsch synthesis to form a predominantly linear hydrocarbon product,

c) isolating a 650°F- containing fraction comprising C_5-C_{20} hydrocarbons and a 650°F+ containing fraction, having a true vapor pressure of less than 15 psia at transportation temperature, from the predominantly linear hydrocarbon product, wherein the 650°F- containing fraction includes greater than 75% by weight 650°F- containing product and the 650°F+ containing fraction includes greater than 75% by weight 650°F+ containing product,

d) converting at least a portion of the 650°F- containing fraction to distillate fuels at the Fischer Tropsch synthesis site,

[d)] e) transporting the 650°F+ containing fraction to a refinery, and

[e)] f) converting the 650°F+ containing fraction to a lube base stock.

3. (Twice Amended) The process of claim 1 [22], wherein [at least] a portion of the 650°F- containing fraction is transported to a refinery and converted to a distillate fuel composition.

10. (Three Times Amended) A process for manufacturing a lube base stock and a distillate fuel including at least one first site and at least one second site, remote from each other, wherein one or a plurality of said first sites form a product used at said second site(s), [said second site(s) forming the lube base stock,] the process comprising:

a) receiving at said second site(s) a 650°F+ containing fraction [made by] and a distillate fuel wherein the 650°F+ fraction and the distillate fuel are made by a process comprising:

linear hydrocarbon product, wherein the 650°F- containing fraction includes greater than 75% by weight 650°F- containing product and the 650°F+ containing fraction includes greater than 75% by weight 650°F+ containing product,

d) converting at least a portion of the 650°F- containing fraction to distillate fuels at the Fischer Tropsch synthesis site,

e) transporting the 650°F+ containing fraction to a refinery, and

f) converting the 650°F+ containing fraction to a lube base stock.

3. (Twice Amended) The process of claim 1, wherein a portion of the 650°F- containing fraction is transported to a refinery and converted to a distillate fuel composition.

10. (Three Times Amended) A process for manufacturing a lube base stock and a distillate fuel including at least one first site and at least one second site, remote from each other, wherein one or a plurality of said first sites form a product used at said second site(s), the process comprising:

a) receiving at said second site(s) a 650°F+ containing fraction and a distillate fuel wherein the 650°F+ fraction and the distillate fuel are made by a process comprising:

i) setting up a Fischer-Tropsch synthesis plant at a first remote location, wherein the plant comprises a syngas generator, a Fischer-Tropsch reactor and equipment for isolating various products from the Fischer Tropsch reactor, and wherein the first remote location has a natural gas source,

ii) converting natural gas at the first remote location to syngas,

iii) subjecting the syngas to Fischer-Tropsch synthesis to form a predominately linear hydrocarbon product,

iv) isolating a 650°F- containing fraction comprising C_5-C_{20} hydrocarbons and a 650°F+ containing fraction from the product of the Fischer-Tropsch synthesis, wherein the 650°F- containing fraction includes greater than 75% by weight 650°F- containing product and the 650°F+ containing fraction includes greater than 75% by weight 650°F+ containing product,

i) setting up a Fischer-Tropsch synthesis plant at a first remote location, wherein the plant comprises a syngas generator, a Fischer-Tropsch reactor and equipment for isolating various products from the Fischer Tropsch reactor, and wherein the first remote location has a natural gas source,

ii) converting natural gas at the first remote location to syngas,

iii) subjecting the syngas to Fischer-Tropsch synthesis to form a predominately linear hydrocarbon product,

iv) isolating a 650°F- containing fraction comprising C_5-C_{20} hydrocarbons and a 650°F+ containing fraction from the product of the Fischer-Tropsch synthesis, wherein the 650°F- containing fraction includes greater than 75% by weight 650°F- containing product and the 650°F+ containing fraction includes greater than 75% by weight 650°F+ containing product,

v) converting at least a portion of the 650°F- containing fraction to distillate fuel at the Fischer Tropsch synthesis site,

vi) [v)] disassembling at least a portion of the equipment in step i),

vii) [vi)] transporting at least a portion of those parts of vi) [v)] to a second remote natural gas field, and

viii) [vii)] assembling a Fischer-Tropsch synthesis plant at the second remote natural gas field comprising at least a portion the parts in step vii), and [vi).]

b) converting the 650°F+ containing fraction to a lube base stock.

11. (Amended) The process of claim 10, further comprising receiving [at least] a portion of the 650°F- containing fraction at the second site(s) and converting at least a portion of said fraction to a distillate fuel composition.

19. (Twice Amended) A process for receiving a Fischer-Tropsch product from converted natural gas wherein the Fischer Tropsch conversion is done at multiple

remote locations, said process comprising:

a) receiving a product manufactured by:

i) setting up a Fischer Tropsch synthesis plant at a first remote location, wherein the plant comprises a syngas generator, a Fischer-Tropsch reactor and equipment for isolating various products from the Fischer-Tropsch reactor, and wherein the first remote location has a natural gas source,

ii) converting natural gas at the first remote location to syngas,

iii) converting the syngas to products via Fischer-Tropsch synthesis,

iv) disassembling at least a portion of the equipment in step i),

v) transporting the disassembled equipment to a second remote location,

vi) setting up a Fischer Tropsch synthesis plant at the second remote location using the disassembled equipment of step iv), and

vii) repeating steps ii) <u>to</u> [and] iii) <u>at the second remote location</u>, and

b) refining the received product.

20. (Twice Amended) A method for manufacturing hydrocarbon products from remote natural gas fields, comprising:

a) setting up a plant to convert natural gas to hydrocarbon products at a first remote natural gas field wherein the plant comprises readily disassembleable and reassembleable components, and wherein the plant converts natural gas to hydrocarbon products,

b) converting natural gas to hydrocarbon products at the first remote natural gas field until the supply of natural gas is substantially depleted,

c) disassembling those parts of the plant which are readily disassembled,

d) transporting at least a portion of those parts of c) to a second remote natural gas field and,

e) assembling a plant at the second remote natural gas field comprising at least a portion of the parts in step d).